United States Nuclear Regulatory Commission

Regulatory Perspective on the Use of Cementitious Materials in Radioactive Waste Management

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Overview

- NRC Interests in Cementitious Materials Applications for Waste
- Issues in the Licensing Arena
- Applicable Areas for Research

NRC Interests in Cementitious Materials Applications for Waste Isolation

- Interests are varied and are aligned with the main functionality of cementitious materials for waste.
- Main functions include:
  - Limit water contact with waste
  - Limit intruder contact with waste
  - Chemically retain radionuclides
  - Provide shielding
  - Stabilize waste (e.g., limit voids and erosion)

Issues in Cementitious Materials Applications for Waste Isolation

- Issues are different depending on the duration (short vs. long half lives), magnitude, and characteristics of the hazard being mitigated.

- For commercial LLW disposal, most radionuclides were expected to decay to insignificant levels by 500 years

  AND

  Justification of performance of cementitious materials beyond this was thought to be very challenging.

Issues in Cementitious Materials Applications for Waste Isolation

- The timeframe for regulatory analysis for waste isolation may extend to many thousands of years or beyond.
- The long timeframe creates additional uncertainty, which may or may not be able to be addressed with research.

NRC Interests in Cementitious Materials Applications for Waste Isolation

- Primary applications include:
  - Grouting of tanks that contain residual radioactive materials
  - Construction of vaults for waste containment/disposal
  - Sealing and filling of voids in systems to be decommissioned
  - Cementitious wasteforms

Uncertainties in Cementitious Materials Applications for Waste Isolation

- The hydrologic properties of cementitious materials over long time periods (> 100 years).
- Unsaturated properties of cementitious materials.
- The limited experience/database of retention properties of cementitious materials for some radionuclides (e.g., Sn-126, Se-79, Np-237).
- The degradation mechanisms and long-term performance of novel formulations (e.g., chemically engineered cements).

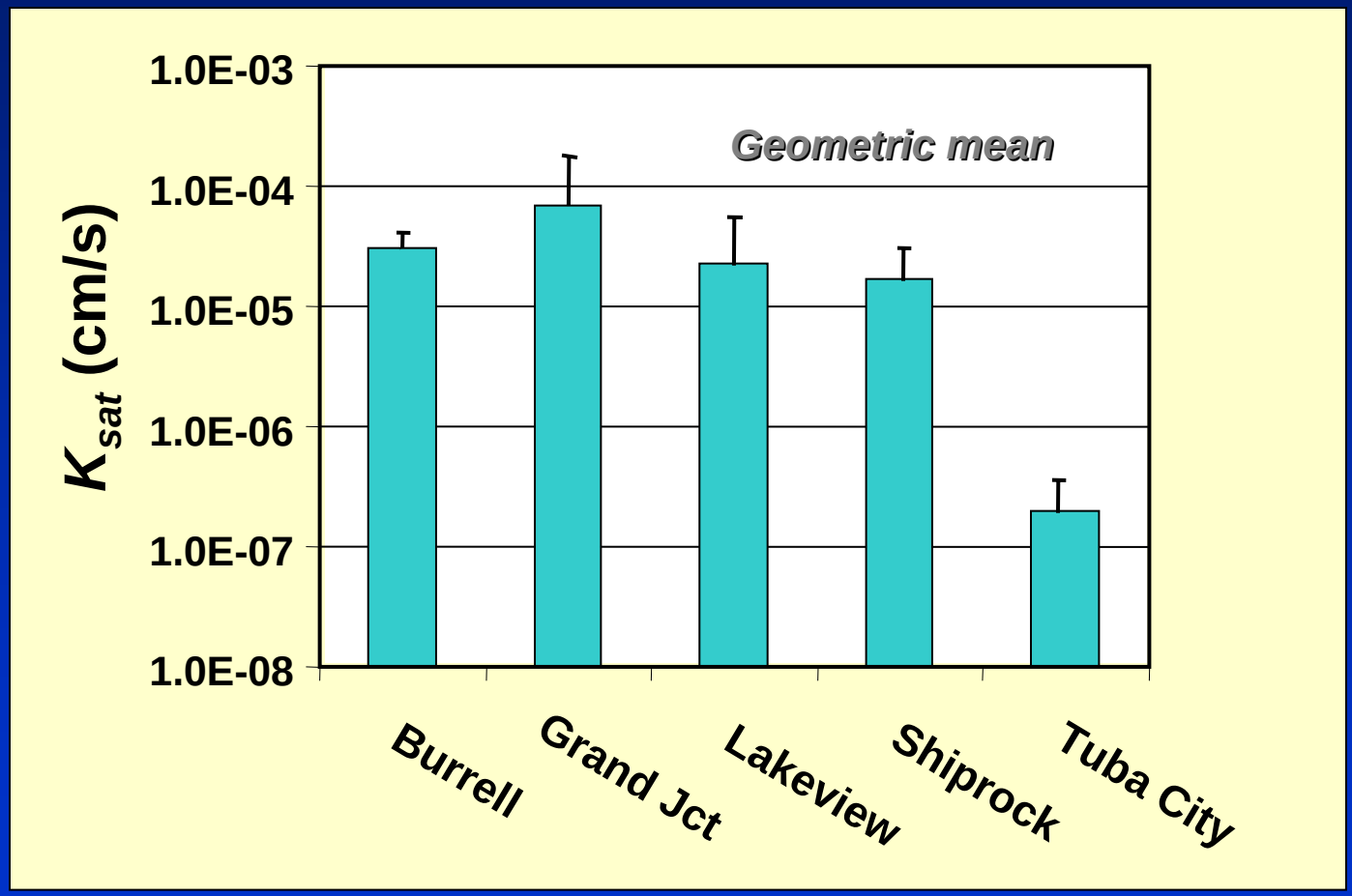
Uncertainties in Cementitious Materials Applications for Waste Isolation

- The validity of and assumed lack of synergism between the degradation mechanisms evaluated with the commonly used empirical relationships.
- The influence of fractures on degradation mechanisms.
- Oxidation of reducing formulations over time.
- Extension of laboratory-scale, short-term tests to large-scale, long-term applications (Does ANS 16.1 address mechanisms relevant to timeframes of 1000's of years?)

Applicable Areas of Research

- Areas of research that may be tractable are:
  - Development of accelerated laboratory-scale test methods.
  - Compilation of a database of international experience (both good and bad).
  - Experiments to estimate the retention properties of cementitious materials for lesser studied radionuclides.
  - Experiments to evaluate potential synergisms between degradation mechanisms, including the impact of fractures.

Engineered Cap Analogy?



From Jody Waugh, Stoller Corp.

Engineered Cap Analogy?

Beatty NV LLW facility